

RESEARCH ARTICLE

Effectiveness of ELT In a Learning Process at B. Ed Level in A Public-Private Institute: A Case Study

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Abstract: The primary aim of this research is to examine the factors influencing the effectiveness of emerging learning technologies (ELT) in the learning processes of student-teachers at the B.Ed. level within a public-private institute. The study adopts a qualitative approach, employing in-depth interviews as the primary data collection method. The research utilizes semi-structured interviews and classroom observations to identify teacher educators' practices in integrating emerging learning technologies at the B.Ed. level and to assess the impact of ELT integration. The SAMR model serves as the framework for evaluating the degree of technology integration. The study's findings reveal that the judicious use of ELT, aligned with subject matter and teacher decision-making, facilitates the achievement of learning objectives, enhances engagement, clarifies complex concepts, and prepares students-teachers for a future dominated by new technologies. Effective and efficient ELT integration into the learning processes of student-teachers hinges on several crucial factors, including the appropriate use of specific online tools, the competency of both students and teachers, alignment of technology, pedagogy, and content knowledge, the teacher's ICT skills and digital literacy, institutional policy, organizational support, and consideration of future workplace resource availability. The study recommends that instructors possess qualifications and skills to effectively incorporate ELT into the classroom, cautioning against a haphazard or uninformed approach that may lead to chaos. Finally, the teachers should consider the institute's goals and future challenges before introducing emerging learning technologies into the classroom, emphasizing the importance of self-reflection on teaching practices to evaluate the efficacy of the implemented tools in terms of pedagogy.

Keywords: Emerging Learning Technologies (ELT), Teaching Practice, Online Tools, B.Ed. Level, SAMR Model

Introduction

The term Emerging Learning Technologies (ELT) refers to the new and innovative online tools, applications, and technological advancements that are used in a variety of educational settings, such as blended, hybrid, and in-person learning. ELTs are available online tools or applications and platforms which can be used to enhance learning experience (Gkrimpizi et al., 2023). Similarly, Wang, F., & Wang, H. (2022) describe emerging learning technologies as digital tools, platforms and innovations that have the potential to transform education, teaching and learning process when utilized effectively such as; learning management system (LMS), online tools for conducting assessments - Kahoot, Nearpod, Padlet, Socratic, Mentimeter, Coggle, Gamification tools, Artificial Intelligence such as ChatGPT, Gemini, Deepsee, Khanmigo which could be used to personalize learning and design teaching and learning resources, e-learning simulation resources

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like virtual reality (VR) and augmented reality (AR) can be used to explain complex and abstract concepts for enhancing learning experience of learners.

According to Garry Falloon (2019) technological advancements can help in comprehending scientific concepts and increase their science knowledge by simulating the manipulation of actual items. Moreover, those who are drawn to the newest technological developments also use terms like "emerging," conceptualizing "newness" as an outward movement (Cook, 2004; Gershon, 2017). In addition to it, the emergence of AI has also transformed the educational process in higher educational institutions as both students and teachers are benefiting from it. Stefan (2017) defines AI, the capability of computer systems to do human-like tasks, including data processing for complex tasks. Onyema (2020), claims that after the development of ELTs, the facet of the educational process has been changed, and it is constantly evolving as the integration of emerging technologies in teaching and in the learning process prominently increases the interest of students as well as the quality of outcomes in the educational process. Subsequently, the effective integration of ELT in educational institutes help preservice teachers to adapt to the changing world of education (Farjon et al., 2018). Besides this, the Donitsa et al., (2020) further supports the claim that integration of technology helps student-teachers in learning how to use technology in teaching practice and how to teach online in today's world. UNESCO, World Bank Group, and ILO (2020) emphasize the importance of future skills and deskillling, particularly learning-to-learn skills, through collaboration between research, education, and industry. Higher education institutions provide training in emerging areas, enabling learners to succeed. A bachelor's degree in education (B.Ed.) prepares students to serve as teachers, accredited by the National Accreditation Council of Teacher Education (NACTE). Johnston et al. (2018) and Shraim (2014) emphasize the importance of training teaching staff to effectively use emerging digital technologies and online tools in the classroom. They also emphasize the need for alignment with pedagogy to facilitate technology-based instruction. (Gallegos and Nakashima 2018; Montgomery et al. 2015; Shraim 2014). Randall Davies (2009) contends that having strong technology literacy is crucial for educators. As it is generally accepted that using technology wisely improves learning. Regardless of the extent of use, haphazard or uninformed technology use could in fact be an indication of a lack of what Mishra & Koehler (2006) refer to as 'Technological Pedagogical Content Knowledge, or TPACK'. The TPACK framework emphasizes the importance of aligning technology, pedagogy, and content knowledge to achieve desired results. It consists of seven components: Content knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical and Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical and Content Knowledge (TPACK). Emerging technologies can deepen student learning and prepare learners for the future. Teachers must effectively use ELTs in teaching practice to model student-teachers to teach with online tools and applications constructively. Teacher educator is defined by Lunenberg et. al., (2014) as a person who teaches or coaches (teacher) students with a goal of supporting their professional development.

Research conducted during the Covid-19 pandemic in 2019 and early 2020 assessed the impact of learning technologies on teaching practices and student engagement both positively and negatively. Bellur, Nowak, and Hull (2015) found that higher education teachers face challenges in keeping students interested in lectures and semesters, leading to students dropping classes, paying less attention to content, and viewing exams as a burden. To enhance pedagogical practices, teachers must measure the efficacy of emerging technologies. The integration of emerging learning technologies in teacher education programs, particularly B. Ed, can enhance student-teachers' learning experiences and equip them with necessary skills and technology knowledge to effectively teach using technology in future classrooms.

Problem Statement

Technology integration in educational institutes enhances student engagement and understanding. However, in Pakistan, post-Covid 19, k-12 learning technologies are incorporated, but higher education levels,

particularly B.Ed., are undervalued, despite the luxury of technological resources available in these institutes. The integration of ELTs helps pre-service teachers develop skills and competencies for purposeful and efficient use of educational technologies in their future classrooms. According to National Professional Standards of Teachers in Pakistan (NPSTP), teacher education institutes are responsible for equipping student-teachers with the necessary skills, disposition, and attitude to effectively use ICT in education settings. This research investigates the effectiveness of emerging learning technologies in preservice teachers' learning processes at the B.Ed. level, focusing on how educators use online resources and incorporate ELT in their four-year Bachelor's in Education degree program, aiming to identify instructional practices and impact on student-teacher learning.

Research Objectives

1. To explore factors associated with effectiveness of emerging learning technologies in the learning process at B. Ed level.
2. To identify the practices of teachers while integrating learning technologies at the B. Ed level.
3. To investigate the impact of integration of emerging learning technologies in the learning process of B. Ed level.

Significance of The Study

The significance of the study is to investigate the effectiveness of emerging learning technologies and describe the role of integrating ELT in the learning process of pre-service student-teachers at the B. Ed level. This research will also help educational leaders and other stakeholders to identify the key factors that are associated with the effectiveness of emerging learning technologies in the teaching and learning process. Moreover, this study will also identify the role of integrating ELT in the teaching process and how the integration of ELTs helps pre-service teachers develop the skills to teach effectively with technology in the future.

Literature Review

The COVID-19 pandemic has significantly impacted traditional learning practices, leading to a surge in technology integration, as highlighted by Ahmed and Opoku (2022), who found that students had to adapt to new learning methods. Similarly, Egloffstein & Ifenthaler, (2021), Iivari et al., (2020) believed that digital transformation has become one of the most prominent issues in the educational setting and directly influences pedagogical approaches and learning process of teachers and students respectively. Furthermore, Patrick (2018) talked on how new technologies are transforming ways educators and students collaborate, communicate with each other, and try to make learning more effective and fascinating. The integration of ELTs in classrooms help student-teachers to stay current on their knowledge and competencies to compete in the future world of education (Parry et al., 2019).

Almara'beh, H., Amer, F.E., and Amjad, S. (2015) state that item technology also includes effective and enhanced learning management systems (LMS), schema of information dissemination, effective teaching and management of student masses, feedback mechanisms and performance evaluation as well as methodologies. Similarly, Edeh Michael Onyema (2020) emphasizes the importance of integrating Emerging Learning Technologies (ELT) in education as a necessity rather than a choice.

On the other hand, pre-service teachers' lack of experience with technology in classroom settings is a significant barrier to their ability to effectively incorporate technology into their teaching (Tondeur et al., 2017a, 2017b, 2018). According to Farjon et al. (2018), teacher education programs and institutes must assist student-teachers in developing their technical skills, pedagogical practices and prepare them for successful technology integration. Previous studies suggest that technology should be integrated throughout the curriculum, rather than just into a specific course. Hence, the knowledge and skills that pre-service teachers

gained from a separate course process are likely to remain unused. The TPACK framework offers guidelines for educators to integrate technology in lessons, focusing on technology, pedagogy, and content knowledge. Each component significantly impacts successful integration. Current practices in classrooms, including scaffolding ELT integration, can directly affect instructional strategies. Pre-service teachers should learn about online tools and how to create a constructive learner-centered learning environment, ensuring that technology, pedagogy, and content knowledge are interconnected and overlap. This will also help incorporate the 21st century skills among student-teachers. One of the best and most efficient methods to teach student teachers or pre-service teachers about technology integration in the classroom is to model or use technology in your own classroom, as stressed by Mong (2015) and Snape (2016).

According to Edgar, Jesus, and Babara (2017), the integration of ELT in teaching improves students' problem-solving and critical thinking abilities. However, Johnston et al. (2018) emphasize the need for educators to be trained to effectively use ELTs in classrooms. Teachers should consider the purpose of an online application and assess its usefulness after its use. It also emphasizes the need for teachers to acquire digital literacy skills to develop and apply relevant ELT across curriculum and content areas, and to adapt to the transforming world of education and emerging classrooms in the twenty-first century. The literature review also indicates a substantial correlation between gamification in education and emerging learning technologies (ELT). Online games use game mechanics and game thinking to solve issues and involve students in interactive learning, according to Takahashi, 2010; Bakhsh, 2016 (Chapman & Rich, 2018). Moreover, Alsawaier (2018) asserts to guarantee that students will acquire the necessary knowledge, skills, or competence while utilizing online games, the teacher's participation is extremely important when choosing a suitable and relevant game. Therefore, gamified quizzes could be used for formative and summative assessments as well. Teachers must evaluate the reasons behind technology integration and analyze the level of integration by asking questions like Why, How, What, and When before using specific tools in their classroom. They should also consider whether the integration of ELT tools can be conducted without it, if it engages learners, and if it transforms the learning experience for student-teachers. According to another powerful framework of technology integration created by Dr. Ruben Puentedura in 2006, the SAMR model of technology integration is a framework which helps educators to evaluate the level of technology integration. The four levels are;

1. **Substitution:** This is the first and lower level of technology integration and it provides a substitute for traditional activities without functional change. Technology is only used to enhance the learning experience of the students. This level involves using word processors for narrative writing or reading e-books instead of printed copies.
2. **Augmentation:** At the second level of technology integration, advanced features of ELT can enhance students' learning experience and activity functionality. For example, students can access online thesaurus or dictionary using a word processor. This level of technology offers increased efficiency, speed, and student involvement, enhancing the learning process.
3. **Modification:** The third level of the model focuses on technology integration to transform students' learning experiences. This stage involves adjusting tasks, achieving new objectives, and improving student outcomes. For example, students might use Google Docs to collaborate on essays and publish them on a blog, allowing for feedback and new interpretations of their studies. This stage significantly enhances the learning process and student outcomes.
4. **Redefinition:** This is the higher level of technology integration which provides the opportunity to educators to transform the learning experience of their students. This level of technology makes it possible to create novel tasks that were previously unthinkable without it. Puentedura claims that at this point, using technology promotes more in-depth analytical thought and results in a noticeable improvement in student performance (Puentedura, 2018). During the redefinition phase, the job can

change from writing a story to creating a digital video narrative that can be shared with students nationwide and used as a resource for others to learn from.

To conclude, the SAMR model's stages 1 and 2 (Substitution and Augmentation) are improvements beyond the current teaching methodologies. The SAMR model's stages 3 and 4 (Modification and Redefinition) stand for transformative learning phases.

Theoretical Framework

This study is grounded in the two frameworks of technology integration. (a) Technology Pedagogy and Content Knowledge (TPACK) by Mishra & Koehler in 2006. According to Koehler et. al., (2007), these 3 components are not just isolated components rather these always work together. Therefore, the teacher must be knowledgeable enough about the relationship between these 3 components, i.e. technology, pedagogy and content knowledge to use technology successfully in the classrooms. The TPACK framework has been used in many studies (Koehler & Mishra, 2008; Mishra & Koehler, 2006). Harris, Phillips, Koehler, and Rosenberg (2017) also stated that this framework has been examined in over 1,200 research papers to date. Therefore, to explore the factors associated with effectiveness of ELT in the learning process and to identify the practices of teachers while integrating emerging learning technologies at the B. Ed level, the TPACK framework is used. Moreover, classrooms were also observed in order to evaluate the level of technology integration and to investigate the impact in the learning process of student-teachers. (b) a four level SAMR (substitution, augmentation, modification and redefinition) model created by Puentedura (2006), was used as a rubric during the classroom observation checklist to evaluate the level of technology integration in the learning of student-teachers.

Research Methodology

The nature of this study is qualitative, because qualitative research enables researchers to look at intricate details about a subject, including relationships between social events, cultural phenomena, and societies via people's perspectives, opinions, behaviors, emotions, and feelings—all of which are reflected in their lives, experiences, and behavior (Creswell, 2007). A case study approach was used to study the phenomena in detail and to get rich data to study about the phenomena. The purpose of using case study approach is to explore the factors associated with effectiveness of emerging learning technologies in the learning process at B.Ed. level.

According to Yin, R. k. (2018), a case study is a method used to examine a recent research phenomenon in depth within its actual environment, particularly in situations where it is difficult to distinguish the boundaries between the phenomenon and its context and multiple sources of evidence are consulted. The research participants were selected purposefully as the student-teachers were selected from different years and the in-service teachers (faculty members) also teaching to the first and last year of B. Ed students who frequently used ELT in their teaching practice. Moreover, classroom observations were also conducted to observe the integration of ELT in the teaching and learning process of student-teachers and to explore the effectiveness of ELT in a learning process at a b. Ed level in a public-private institute. A checklist and observation protocol were developed for classroom observation, inspired by previous research. These tools are crucial for analyzing pedagogical and instructional approaches, technology integration, and student learning, as emphasized by Bielefeldt (2012).

The classrooms were observed by the researchers for the whole slot of 105 minutes. The classroom observation protocol contains three levels of technology integration i.e.

1=minimally, 2=partially and 3=fully.

1. Partially = Technology is integrated to support teaching and learning process.
2. Minimally = Technology is integrated to support teaching and learning process effectively.
3. Fully = Technology is integrated appropriately to support the teaching and learning process.

The classroom observation protocol contains the 4 levels of the Purpose of Integration ELT (acc. SAMR Model).

1. **Substitution:** Technology is integrated for the purpose of enhancement just to increase student engagement during the lesson.
2. **Augmentation:** Technology is integrated for the purpose of enhancement with the aim of improving the functionality of the activities during lesson.
3. **Modification:** Technology is integrated purposefully to achieve learning outcomes effectively and to increase the productivity of the work.
4. **Transformation:** Technology is integrated purposefully and appropriately to transform the learning experience of the student-teachers.

Population and Sample Size

The study involved six in-depth interviews with three teacher educators and three student-teachers at a public-private institute, using purposive sampling technique. This method, also known as judgmental, selective, or subjective sampling, relied on the researcher's judgment in selecting study units.

Research Participants

The study involved three 23-30-year-old female student-teachers and three teacher educators, two teaching science pedagogy and the other teaching mathematics, aged 32-40, at the public-private institute of four years undergraduate bachelor's in education degree program.

Data Analysis

Multiple reviews and analyses of the data were conducted to determine distinct codes that will be combined into distinct themes. Deep analysis of the interview transcript required for the first cycle of the coding process, known as initial coding. New codes were assigned to each statement that presented a novel idea, while statements that shared commonalities with previously coded statements were added to existing codes.

Data Analysis, Findings, Discussions

The findings of the study show that emerging learning technologies (ELTs) are frequently used in student-teacher learning processes, positively impacting learning and developing 21st-century skills. The efficient use of online tools and applications at the B. Ed. level enhances the learning process. Moreover, the efficiency of the learning process at the B. Ed. level is enhanced by the appropriate use of online tools and applications. Finally, the results also identified the factors associated with the effectiveness of ELT integration in the student-teacher learning and how these factors significantly impact the learning process.

Significance of ELT in Teaching and Learning Process of Bachelor's in Education Degree Program (B.Ed.)

Despite limited resources, many institutions have incorporated learning technologies into their teaching methods. Teachers initially faced challenges, such as lack of knowledge about specific tools and resources. The findings revealed that teachers recognized technology integration as more important than ever. As one educator research participant (ERP1) stated, "I remember during Covid, we had to go online. And suddenly our teaching cycle got disrupted. I used a lot of digital manipulatives during online classes to teach the complex concepts."

Pakistan, an under-developing country with a 58% literacy rate (World Population Review), recognized the importance of technology integration post-COVID-19. Participants shared that emerging learning technologies are regularly used in their teacher education program, giving them exposure to various ELTs applicable in teaching. Teacher educators also highlighted the significance of integrating ELTs and their impact on student-teachers' learning: "Integrating these emerging learning technologies in a classroom gives

a multi-modal aspect to a lesson, which increases student engagement” (ERP2). The 2020 EDUCAUSE Horizon Report: Teaching and Learning Edition explores six emerging learning technologies and practices that significantly impact education. The report notes these technologies can simplify processes, enhance content, improve interaction, and personalize learning experiences with future implications.

Findings also showed that integrating ELTs into student-teachers education help them effectively in achieve learning objectives. ERP3 highlighted, “It's very important for student-teachers to be aware of the tools which can be used for classroom teaching, and it will also increase their tools repertoire.”

Educators believe it is teacher educators' responsibility to equip student-teachers with skills to use technology in future classrooms. Teacher educators agreed that ELTs play a vital role in supporting teaching: “Biggest benefit I have had in math is that it strongly supports pedagogy and aids visualization.” (ERP1)

Thus, ELTs support pedagogical practices and offer student-teachers' opportunities to assess tool appropriateness in teaching and learning process. Marcy Zipke et al. (2019) referenced a survey (Polly, Mims, Shepherd, & Inan, 2010), and according to the results, student-teachers who participated in technology-rich units in their methods courses showed increased comfort and creativity in using technology with students, contrasting with standalone technology courses that focus solely on technological tools without proper pedagogy or subject matter expertise.

Effective Integration of Learning Management System at Institutional Level

With the advent of new technological solutions and creative digital opportunities like learning management systems (LMS), higher education institutions are currently experiencing a paradigm shift in education and new approaches to the organization of the teaching and learning process. LMS is one of the most important components of organizing, sharing and accessing educational resources. According to Chanjaradwichai et al. (2019), an information management system called a LMS, includes a number of tools aimed at increasing the effectiveness of classroom management. In this public-private institution there is an extensive use of Microsoft Suite and Microsoft Teams for assignments and sharing content during classes across different courses and the diverse range of tools employed to facilitate learning. The Microsoft team is a learning management system (LMS) which is used to share and access resources. The student-teachers think that Teams is a very useful platform for accessing resources and collaborative tasks and they were not aware of LMS and its use earlier, “Teams is an LMS, and we think that it is very effective for teaching and learning purposes” (ST2).

The teachers also believed that the integration of LMS at institutional level is also plays a prominent role in the effectiveness of student's learning as it offers a variety of online resources which could be apply for number of purposes to support learning, “for collaborative learning, often times we create shared documents on Microsoft Teams, so it lends a lot of efficiency to the whole classroom experience” (ERP2).

According to Hena Dian Ayu et. al., (2023) LMS is applied at the modification level and the integration of LMS at an institutional level helps students learn to solve problems and learn new concepts or ideas collaboratively. The institute's student-teachers use ELTS frequently at a B. Ed level. However, the integration of ELTs is at different levels of the SAMR model as it was observed during classroom observations and student-teachers also highlighted the experience of using various ELTs in their courses. “We don't use paper; we don't have books. In fact, everything is digitally done” (ST1).

Similarly, some of the student-teachers prefer using the online tool NOTION for note taking and organizing the information, whereas others prefer using MS Word for jotting down the important points during the lecture. “I use it for notetaking and also organizing all my other data as well in my personal life also. It is a very creative approach to note taking” (ST2).

According to Marcy Zipke et al. (2019), this indicates that the teachers and student-teachers used these ELTs as a way of substituting it for paper-and-pencil tasks.

Role of ELT In Developing Essential Skills in Student-Teachers

ELT integration helps student-teachers develop essential 21st-century skills like creativity, critical thinking, problem solving, communication and collaboration. The development of these skills is a key finding of this study. One participant (ST3) shared, "I believe it assisted me in developing my creative and visual skills as well as my ability to arrange data or information effectively." Participants felt ELT enhanced their ability to organize and present information creatively, which positively impacts future teaching practices and personal growth. Also, ELT supports diverse learning styles and fosters soft skills through access to tools to organize information effectively using online tools such as Notion, chatbots - ChatGPT and Learning Management Systems (LMS). In addition to it, access to emerging technologies like AI tools also provides opportunities to student-teachers to gather information quickly. But students need to improve their digital, information and media literacy skills which are one of the most important skills one needs to survive in this globalized world of bombarded information. Stucker (2005) highlights the need for educators to teach students how to effectively use AI tools like ChatGPT and Gemini, despite their good information-gathering skills. Educators play a vital role in guiding students to use ELTs effectively to encourage creativity and problem-solving. The pedagogical approaches used by teacher educators while using AI tools promote critical thinking and problem-solving skills among student-teachers, improving their overall learning process.

"The tasks help me to improve digital literacy and media literacy skills" (ST1)

"With the right strategies, critical thinking skills can be developed. So, we have to compare it with the other information that we get from the Internet. So, when we analyze it, critical thinking is promoted" (ST2).

"Digital tools like Google Docs and CANVA enable student-teachers to creatively present ideas and work collaboratively, building communication skills" (ERP3)

The institution is focusing on teaching student-teachers the importance of critically evaluating online content to prepare them for the future AI-enabled world. This approach aims to prepare teachers for meaningful contributions and the role of knowledge workers in the 21st century. Teachers can develop 21st-century skills, such as communication, cooperation, critical thinking, and creativity, using SAMR in technology-infused classes. This is crucial for preparing teachers for complex workplaces in the 21st century. According to Stucker (2005) and Helen Crompton (2020), successful integration depends on the task's nature and alignment with pedagogy.

Integration of ELT to Transform the Learning Process of Student-Teachers

The use of specific online tools and applications plays a prominent role in teaching particular courses at B. Ed level. The educators carefully selected the ELTs to integrate in their lessons to increase the effectiveness of the student-teachers' learning process. The lessons of the teacher educators were observed to be largely student-centered, partially and fully ELT integrated. Teacher educators integrated the ELT in their lessons purposefully to transform the learning process of preservice teachers. Utilizing specific ELTs, including digital simulations and online applications such as Phet, Gizmo, Geogebra and digital manipulatives, enables pre-service teachers to comprehend material in-depth and apply what they have learned to real-world situations.

Utilization of Simulations to Teach Scientific Abstract Concepts: The findings of the study revealed that the use of simulations is really helpful in teaching science and math pedagogy courses to student-teachers as it helps them to visualize the concepts more effectively as compared to using videos. The effective utilization of these resources also help teacher educators to clear their student-teachers' misconceptions about specific concepts. "ELT can provide tools of visualization which otherwise would not have been possible" (ERP1)

Tunjera and Chigona (2020) suggest that content-specific ELT resources like Phet and online simulations enable in-depth comprehension of content, enabling student-teachers to apply knowledge in real-life scenarios, and enhance lesson effectiveness and student-teacher engagement. Alandeom Oliveira, et. al. (2019) emphasizes the importance of experiencing science through its technological dimension. Student-teachers found simulation resources; online virtual reality (VR) tools effective in understanding complex science concepts, such as the PHET Colorado website, which provides real-life applications of scientific concepts. ST3 shared, "We were studying the states of matter topic using PhET and observing how matter is changing into solid and liquid states."

Brinson (2017) conducted a literature review associated with the attainment of learning objectives by students in unconventional science labs; virtual and remote as compared to traditional hands-on. The reviews all agreed that the implementation of simulation technology has an overwhelmingly beneficial impact on student learning. The integration of ELT resulted in a more visual engaging and aesthetically pleasing science learning experience.

Gamification also engages learners through virtual platforms. "The use of game design elements, game-play mechanics, aesthetics, and game thinking for non-game applications to motivate students" is what Kapp (p. 10) defines as gamification. The student-teacher shared the example of using an online simulation game for her science lesson, "I remember a science pedagogy class in which we used an online game to measure body fat and the food intake in the body" (ST3). According to Michail Kalogiannakis et al. (2020), there has been a lot of interest in educational concepts being integrated into gamified scientific thinking-facilitating tools and techniques.

The integration of ELTs like PhET and GeoGebra demonstrates how carefully selected digital tools enhance comprehension and real-world application. Virtual labs offer immersive learning for abstract science topics, while game-based applications foster student motivation and interaction. These practices highlight how ELTs transform teaching by enabling deeper engagement, creativity, and conceptual clarity.

Effective Integration of Geogebra in Teaching & Learning of Complex Mathematical Concepts: GeoGebra, an open-source mathematics application, combines geometry and algebra to enhance understanding of complex concepts. According to Zutaah Puotier et al. (2023), integrating technology like GeoGebra stimulates curiosity, boosts motivation, and improves the effectiveness of pre-service teacher education. Shadaan and Eu (2013) also highlight its value in enhancing understanding of geometry.

A lesson observation in a seventh-semester B.Ed. class showed effective use of GeoGebra to teach trigonometry. One of the teacher educators shared, "I had started with chart paper drawings... but they could not still fully internalize the relationship. Then I used GeoGebra, and it helped me to explain the concepts by simulating it." ERP1 also emphasized, "The use of simulation for explaining complex mathematical concepts worked like magic. Students were able to understand it immediately and it was very effective." The integration of Geogebra aimed to enhance content comprehension and interest among students-teachers, who struggled with traditional teaching methods. The application was used to explain right triangle and ratios concepts, helping students visualize and understand these concepts effectively, which also cleared their prior misconceptions related to the topics.

Segal, Oxman, and Stupel (2021) examined the role of technological and pedagogical knowledge in transformation of pre-service teachers of mathematics. Twenty-seven aspiring educators pursuing qualification as professional teachers participated in the study. According to the findings, the majority of aspiring educators (more than 80%) said that GeoGebra is an effective teaching tool for revising and improving students' understanding in transformation. This suggests that the GeoGebra application positively influences the learning process of student-teachers.

Zutaah Puotier et al. (2023) found that students dislike studying geometry due to abstract concepts, but GeoGebra simulations significantly improved their understanding of trigonometry ideas, according to a student-teacher study. Not only that, but it did also make them want to learn trigonometry in greater detail and depth. ST3 shared, "I always used to skip trigonometry in my board exams, and I wanted to understand the same topic in greater depth with which I used to run." ERP1 added, "A couple of students actually came to me as they want to use the same application to teach their peers or the children that they tutor in their free time."

GeoGebra's impact also depends on instructional strategies. In some lessons, Geogebra was used to explain concepts, with students passively viewing rather than engaging in hands-on experiences. Student-teacher involvement was passive, with the focus on understanding and applying trigonometry knowledge, rather than exploring other aspects individually.

The SAMR model identifies GeoGebra as a transformative tool for teaching complex concepts enabling dynamic modeling and deeper understanding (Tunjera & Chigona, 2020; Oliveira et al., 2019; Bower et al., 2020; Keane et al., 2023; Brinson, 2017; Kalogiannakis et al., 2020; Kapp, p.10; Puotier et al., 2023; Shadaan & Eu, 2013; Segal et al., 2021). However, it is more important how teacher uses the tool. However, Higgins and Raskind (2005) argue that the impact of technology use varies depending on the characteristics of teachers and students, as well as the task at hand, and that it may not improve learning outcomes at the modification or redefinition level.

Use of AI to Transform the Teaching and Learning Process: Emerging technologies like AI offer new opportunities for effective teacher preparation. Integrating such tools with course goals can shape pre-service teachers' beliefs and improve learning outcomes (Gordon et al., 2015; Russell et al., 2003). While educator adoption has been gradual, AI continues to influence higher education globally (Schiff, 2021; Bjork, 2023).

The 21st century, as the "digital knowledge age," has seen the rise of tools like ChatGPT, reshaping how we learn, access, and create knowledge (Stefan et al., 2017). ERP1 remarked, "For my learning, I use artificial intelligence a lot. Especially the Gemini. It saves a lot of time."

AI is transforming teaching, learning, and administration, even raising discussions about teacherbots—AI programs that support online learning (Bayne, 2015; Botrel et al., 2015; Popenici & Kerr, 2017). ST3 shared, "I appreciate that AI is being accepted here," while ST2 added, "AI is the best tool that we are using a lot these days. There are a lot of ideas for activities and stories that we take from AI."

A classroom observation in semester one highlighted how student-teachers used ChatGPT to design 5E lesson plans. The teacher facilitated, while students used AI to generate ideas, search for videos, and download planning templates from Microsoft Teams (LMS). ERP2 observed, "ChatGPT is using frequently in our classrooms."

Faculty members also rely on AI in teaching. ERP2 stated, "Whenever I have to design rubric for any activity, I use Bard...," and added, "I use AI tools to generate resources for my teaching and for my assessments." She further shared, "It helps me to manage time more effectively." ST1 echoed this, saying, "For lesson planning specifically, I use BARD because it is up to date as compared to ChatGPT."

AI enables real-time help, reduces waiting for instructor responses, and supports personalized learning (Kaplan et al., 2023; Chen et al., 2023; Eicher et al., 2018; Goel & Joyner, 2017). Institutions must rethink their roles and strategies as AI integration in B.Ed. programs benefits both in-service and pre-service teachers by enhancing their professional growth and instructional efficiency.

ELT Can Be Utilized for Making Assessment More Purposeful: Emerging Learning Technologies (ELTs) are increasingly used to assess B.Ed. students' learning, offering more authentic, paperless assessment

opportunities. Tools like Mentimeter, Microsoft Forms, ChatGPT, Canva, Nearpod, Kahoot, and Google add-ons serve both formative and summative purposes (Tristan Lim et al., 2022; Bearman et al., 2023).

"There is a variety of assessment tools available and all of these tools have something different to offer... it depends on which type of learning you want to assess" (ERP2). ERP1 added, "I use a lot of assessment tools... You can always use them as tools for formative assessment, end-of-lesson assessment."

The SAMR model encourages educators to reflect on how technology enhances or transforms assessment (Bearman et al., 2023). ERP1 shared, "I have been using Microsoft Forms a lot for the past year and a half."

Assessment also informs instruction. ERP2 noted, "The assessment drives learning, so, unless I can assess students efficiently, I cannot adapt my instruction accordingly."

Student-teachers shared their mid-semester assignment using Canva: "We got a marked assignment of 30% weightage of designing an anchor chart on Canva... our teacher assigned us an SLO from the Single National Curriculum for science, and we had to design a chart accordingly." This task encouraged creativity, critical thinking, and integration of prior learning.

Other frequently used ELTs include Prezi, Nearpod, WordWall, and Simple Assign. The latter allowed students to indicate SLO preferences for their assignments. "Simple Assign" facilitated fair and bias-free allocation based on student input.

These examples highlight how ELTs make assessment more engaging, personalized, and aligned with modern pedagogical goals.

Factors Associated with ELT's Effectiveness in the Learning Process

The findings revealed that incorporating ELT into student-teacher learning processes has a positive and greater impact on the effectiveness of improved learning outcomes, encourages curiosity and engagement, aids in the understanding of difficult concepts, and, finally, encourages the development of 21st-century skills necessary for success in the workplace. However, there are a few things to keep in mind when implementing ELT in the classroom. Competent teachers, pedagogy, content, and technology alignment, resource availability, students' competency level, the purpose of utilizing ELT, appropriate use of online tools and applications, and being realistic for future scenarios while preparing student-teachers for the government sector are all factors linked to the effectiveness of ELT in the B. Ed level learning process.

Alignment of Technology, Pedagogy and Content Knowledge: Findings reveal that effective ELT integration requires alignment between content, pedagogy, and technology. Educators must ask, "Do I want this, or do I need this in my lesson and how will this make my lesson more effective?" (ERP2).

Rafael Winícius et al. (2023) emphasize that teaching with technology demands a clear understanding of its pedagogical purpose. Similarly, Marshall & Cox (2008) and Angeli & Valanides (2009) stress that technology should serve educational goals—not technological trends. ERP2 noted, "When I use ELT in my lesson, then it needs to enhance the effectiveness... and students' concept clarity should be enhanced."

The TPACK framework (Koehler et al., 2014; Mishra & Koehler, 2006) helps teachers integrate pedagogy, content, and technology simultaneously. As ERP2 explained, "For pedagogical purposes, the whole pedagogy needs to be planned... like which methods and tools to use."

Teachers need not use ELT in every lesson. ERP1 stated, "In terms of content comprehension, the ELTs have been extremely helpful. But in terms of developing students' pedagogical skills, I think I use it with some caution."

Educators must reflect on methodology before selecting tools. ST2 noted, "Before integrating tools, teachers need to consider their teaching style or the methodology they are going to use." Tondeur et al. (2012) recommend teacher educators act as role models in integrating ELT meaningfully into teacher preparation programs.

Student's & Teacher's Competency level in using ELT Impacts the Effectiveness of Learning Process:

Research participants emphasize the importance of considering factors like teacher comfort, student competency, learning styles, and teaching objectives when integrating technologies. They highlight the complexities of ELT implementation and the need for thoughtful planning to ensure effective ICT integration in education (e.g., Fraillon et al., 2020; Ottenbreit-Leftwich et al., 2018). Teachers with strong digital literacy can promote meaningful learning (Crompton, 2017), guide students in producing real-world knowledge (Ertmer & Ottenbreit-Leftwich, 2010), and enhance teaching efficiency (Basher, 2017). Teacher educators emphasized the need for competence with tech tools: "Teachers should be able to use technology in order to effectively use it" (ERP1).

Cloete (2017) noted a clear correlation between teacher competency and student achievement. A student-teacher added, "The teacher should be comfortable enough to use the specific tool or application and need to consider whether the students will be able to use it or not" (ST1). Another shared, "It is very important that the teacher knows what the student's competency level is" (ST3).

Student-teachers stressed assessing students' prior knowledge before introducing ELT. Knowing students' capabilities with online tools is essential for effective ELT integration. Teachers must be skilled in using ELTs to foster engagement and improve outcomes.

Viridi (2017) supports multiple intelligence theory and highlights using technology to address varied learning styles. Alenezi (2020) also observed that ELT effectiveness depends on differences in how learners respond to various channels: "It helps in creating a differentiated learning environment" (ST1).

Literature affirms that students' learning styles vary, and teachers and students believe ELT integration helps meet those diverse needs.

Appropriate Use of ELT in the Classroom to Support Learning: The effectiveness of learning can be significantly enhanced by teachers' awareness of available ELT resources. If educators are unaware of these, lesson effectiveness may decrease. Various pedagogies and models have been developed to enrich students' educational experiences, making it essential for educators to stay informed (Tobias et al., 2014; and 2012, n.d.; Technologies & 2014, n.d.). Moreover, various models emphasize using technology in education, including tools and software. Facilitators must evaluate these tools' advantages to determine their suitability for specific learning tasks and potential benefits for student performance (Lydia et al., 2023). "I have been teaching specialization courses for the past two years. I think I am still not utilizing ELT to its fullest capacity" (ERP1).

Literature suggests that the SAMR model can guide teachers in a rapidly evolving technological world, helping them select instructional aids. In addition to SAMR, educators should consider how technology enhances and amplifies learning, with a primary focus on meaningful instruction rather than just tool use (Hamilton et al., 2016).

Institutional Policy and Challenge of Lack of Resources in Future Workplace: Institutional policy is another factor teacher educators must consider before integrating ELT in teaching. To model effective ELT use for student-teachers, it is essential to explore how teacher educators can be supported in adopting new technologies. "The reason for that is that the institute has an emphasis on using low-cost, no-cost material so that we can model what can be taught in government school settings with little resources" (ERP1). Student-teachers also recognized the future challenges: "Because we are going to teach in government schools, and we need to realize that it will not be available all the time" (ST1). Another participant highlighted this concern: "If we look at the government sector, there is an issue of resources" (ST3).

The UNESCO Global Education Monitoring Report (2023) highlights resource scarcity as a major barrier to technology use in education, particularly in preparing student-teachers for government schools. Limited access to tools like projectors and multimedia hinders education quality. “Since we are preparing the teachers for the government school sector where there are no technologies as such, keeping that factor in mind, then we have to create a balance of using technology” (ERP1).

Conclusion

Emerging learning technologies (ELTs) are revolutionizing the teaching and learning process, especially for student-teachers preparing for a technology-driven educational future. Integrating ELTs enhances the B.Ed. student-teachers’ learning process by offering diverse resources and fostering critical thinking, creativity, and digital literacy.

At the core of effective ELT integration lies the SAMR model, which categorizes technology use in four levels: substitution, augmentation, modification, and transformation. Observations reveal that teachers often use ELTs at the enhancement level for formative and summative assessments, while AI tools like ChatGPT push the boundaries towards transformation. Simulations, on the other hand, can modify or even transform complex concept explanations. However, the use of simulations depends upon its use. It could be integrated at enhancement level or at transformation level.

However, successful ELT integration hinges on several factors. Alignment of technology, pedagogy, and content knowledge (TPACK) is crucial, alongside choosing the right ELT for the specific task and considering student and teacher competency levels. Moreover, the nature of the task. Additionally, catering to diverse learning styles and institutional policies, including future considerations for government sector employment where resources might be limited, are essential.

In conclusion, ELTs offer immense potential to prepare student-teachers for the future of the world of education. By embracing diverse technologies with a focus on TPACK, appropriate selection, alignment and learner-centeredness, teacher-educators empower student-teachers to lead the way in an ever-evolving technological landscape.

Recommendation

The study recommends that teacher educators need to be careful while planning their lessons for ELT integration. They must ensure that technology, pedagogy and content knowledge need to be aligned to enhance the effectiveness of learning of preservice teachers, the demonstration and modelling of the ELT should be appropriate and helpful in achieving the learning outcomes effectively. The teachers must be competent and up to date with the relevant ELTs that could be incorporated appropriately with the learning objectives. The purpose of ELT integration should be to enhance the learning experience of student-teachers rather than haphazard integration just for the sake of technology integration. Moreover, teachers could take guidance from the SAMR model for the purposeful integration of ELT and evaluate the level at which they want to incorporate technology, i.e. enhancement or transform the learning experience of student-teachers. However, the nature of the task and pedagogy needs to be considered as well.

Suggestion for Future Study

This study explored the factors associated with the effectiveness of ELTs in the learning process of female student-teachers and teacher educators' practices of integrating ELT in content-specific courses, such as Languages, science, and mathematics pedagogy, for B. Ed students of a public-private institute. Further studies could be conducted to explore more factors associated with the effectiveness of emerging learning technologies in the learning process of male student-teachers, as well as the teachers' practice of incorporating ELT in the learning process of other courses offered at the four years of B. Ed level (B. Ed elementary).

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